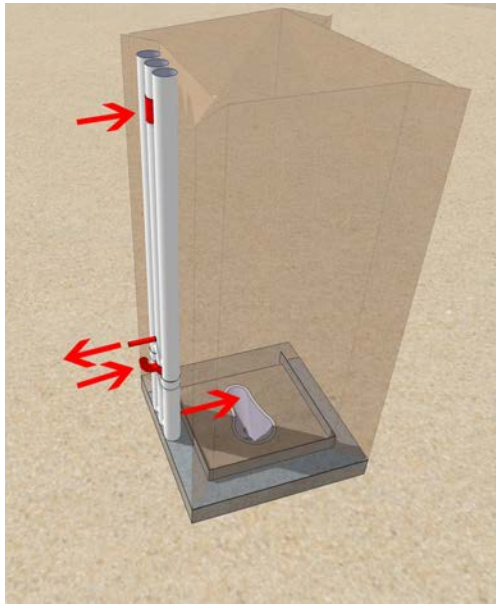
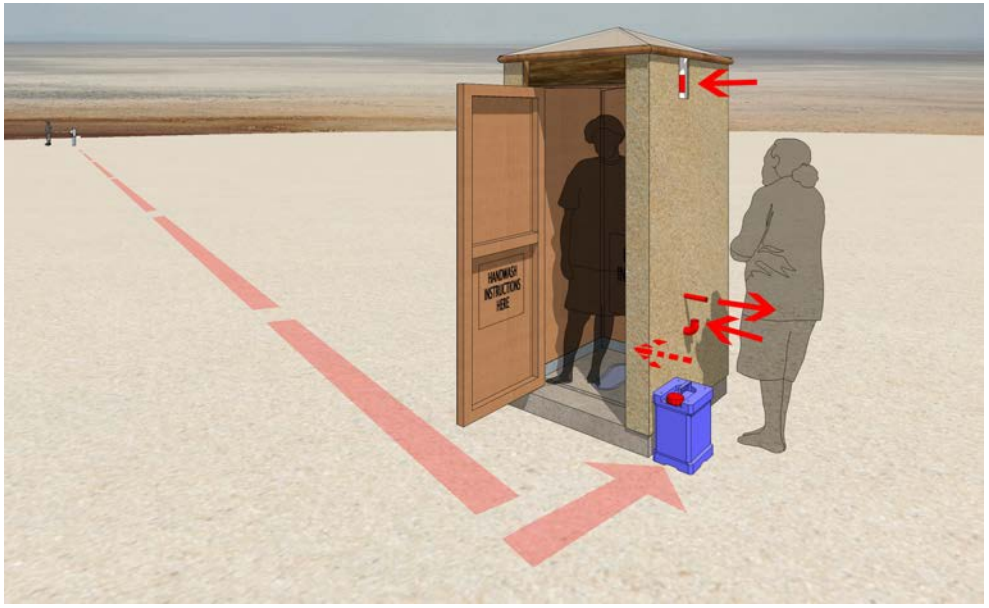
The Sydney 2 x 2 x 2 x 1 Challenge (2 litres, 2 hands, 2 eyes, 1 day)

Reducing trachoma in Ethiopia: an initiative of The Fred Hollows Foundation with help from Healthabitat and students from Notre Dame University and the University of Sydney

The challenge was set for teams comprised of medical, architecture, industrial design and engineering students.
Research, think, develop and design ways to use minimal quantities of water to enable children (first priority) and adults to wash their hands and faces to remove the trachoma bug and any remnant food or dirt that has collected on the face that may attract flies.
Fabricate and assemble the solution.
Participate in the testing of the design solution and construction quality.

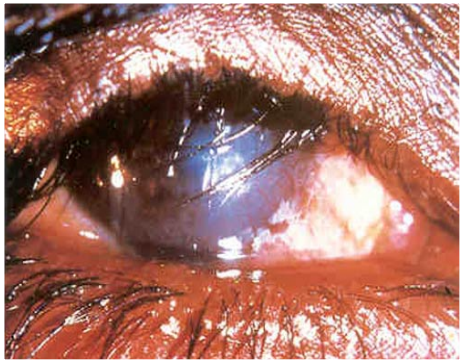




How to get water from the supply point to be stored near the toilet and then use very small amounts of from the local toilet reservoir to the faces and hands of all residents and finally, use the waste water for toilet floor cleaning, are all key parts of the problem.

'Thus, the continued provision of MDA (Antibiotic) cannot alone constitute an effective and sustainable approach to elimination of blinding trachoma."

To quote WHO's GET 17 Report, "The Face Washing and Environment improvement components of the SAFE strategy must be integrated into the overall strategy in a coordinated way with the involvement of all partners. ***WASH interventions are often perceived as complex, costly and infrastructure-based*** *but that is not necessarily the case if the right partners are involved, as shown by the examples of the Gambia and Ghana."*



(S) Surgery and (A) **A**ntibiotics

+

(F) Face cleanliness & (E) **E**nvironment improvement
(water for face washing & sanitation to reduce flies)

=

The setup for the Challenge

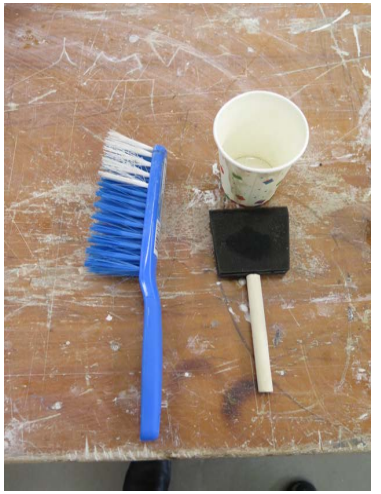
Ply panels for each team

the face dirt kit and samples (above)

the hand mud and cleaning brush

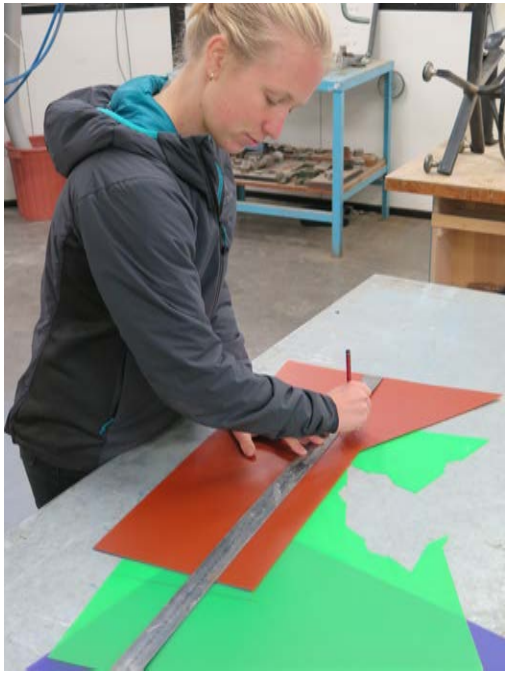
The water buckets (2 x 5 litre and 1 x 2 litre)

the warning white board






The workshop preparation

Pre - Challenge testing

Pre - Challenge testing

JUDGING CRITERIA

Face washing
All team members, a min. 5 of people, are to wash their 'standard' dirty faces. The 'dirt' will be applied to 5 members of the team. Sample 'dirt' was made available for team testing. After washing, faces were blotted/wiped dry on a paper towel, provided by HH. The towels were later assessed. The dirt on the towel was a measure of how much dirt was left on the face *after washing*. **The cleaner the towel the more points gained.**

Hand washing
All as above with 'standard' dirty hands from bucket of mud.

Toilet floor washing
Water was used to wash 'standard' dirtied concrete floor area provided. A blot test with paper towel assessed cleanliness after washing.

Water security
Total volume of clean water left over after all the above was measured. Points were awarded for remaining water from the 10 litre allowance.

Other criteria for the judges.
Cost efficient?

Robust technology for the task?

Will it be used?

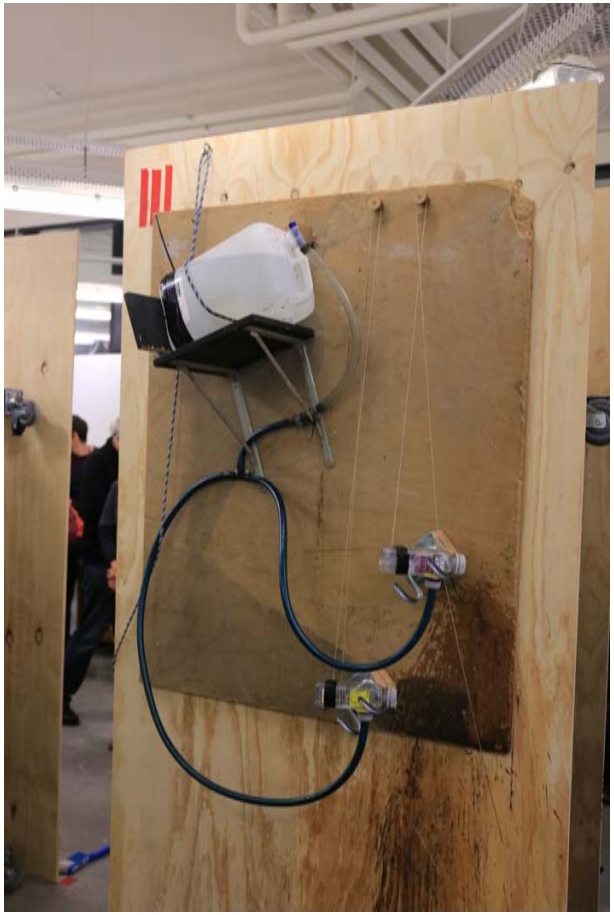
Will kids be able to use it?

TEAM 1 1st place

Face washing – good
Hand washing – good
Floor washing – good with remnant water via basin
Water remaining - + 7 litres
Cost – expensive but available drainage pipe
Technology – common parts and robust, 3 moving parts
Usable – simple to fill and use, waste water captured
For kids – height OK, no particular kid friendly parts

TEAM 2 3rd place

Face washing – good steady stream recharged when needed
Hand washing – as above
Floor washing - simple sink collected water and stored for floor wash, good
Water remaining - + 6 litres
Cost – many constructed parts for prototype would not be used in field version
Technology – face spray did not work
Usable – simple stream OK
For kids – sink useful for mothers and young children



TEAM 3 4th place

Face washing – OK – very slow stream
Hand washing – OK – very slow stream
Floor washing – no water collected for this
Water remaining - + 8 litres, foot control valve
Cost – good - used found vessels with minimal built components
Technology – common parts, pipes and delivery bottle mechanism need refinement
Usable – hard to fill and use, no waste water captured
For kids – 2 heights, foot valves could be attractive to kids …maybe too attractive ?

TEAM 4 2nd place

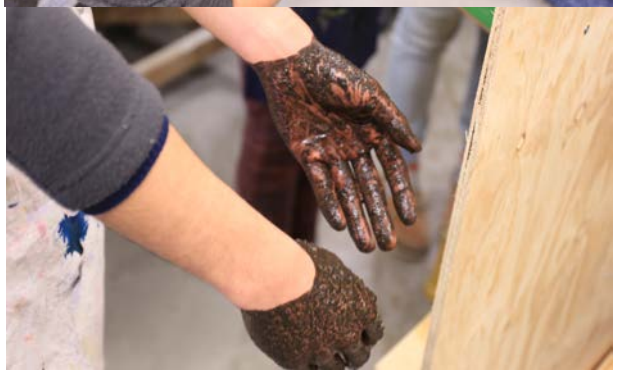
Face washing – good – slow stream
Hand washing – good – quick stream
Floor washing – good with remnant water via basin
Water remaining - + 6 litres, stop valve foot operated
Cost – used found vessels with minimal built components
Technology – common parts and robust, pipes and stop valve need refinement
Usable – simple to fill and use, waste water captured
For kids – height OK, foot valve could be attractive to kids …maybe too attractive ?

TEAM 5 5th place

Face washing – OK – very slow stream mist spay did not function
Hand washing – OK slow stream (dependent on bucket filling during test)
Floor washing – no collection of remnant water
Water remaining - + 5 litres, leaks in system
Cost – some hi-tech 3D printed components
Technology – poor construction made the system hard to evaluate
Usable – high to fill and use, waste water not captured
For kids – height OK, no particular kid features working *but* 'nose and eyes' good for face washing if lower down.

FACE

Replica Dirt: Nutella, vegemite, LSA, Honey
Measure: Equal cupcake cups and painted onto forehead, cheeks and nose of 5 adult faces with same brush



HANDS

Dirt: Soil and Water
Measure: 2 x 50 cent pieces at bottom of bucket, each hand had to find a coin before pulling hands out

FLOOR

Dirt: Soil and Water
Measure: One full cup of soil and dirt, poured and smudged on concrete floor under.

PAPER TOWEL

After washing, 5 members on each team* dried their hands and face on paper towels squares (1 per hands and 1 per face)
The marked floor area adjoining the test panel, representing the toilet floor, was blotted with a square of paper towel after washing down by the group.
The judges could review the remaining dirt captured on the paper towels as a measure of the effectiveness of each Team's system.

** NOTE: Where teams had less than 5 members, they were helped by volunteers to make up the 5 needed for washing as this represents the average family size in Ethiopia.*

GUEST JUDGES

Harry Partridge *Partridge Structural*
Brian Doolan CEO *The Fred Hollows Foundation*
Dr. Paul Torzillo *Healthabitat*
Karin Richards *Healthabitat*
Adriano Pupilli *AP architects*
Jeff Standen *NSW Health, Aboriginal Environmental Health section*
Dr Indy Sandaradura, *microbiologist, University of Notre Dame Australia*
Sydney Uni Architecture Faculty lecturers and tutors (Jonathon Temple, Michael Muir, all the Workshop crew)

The Challenge teams were coordinated by Jasper Ludwig






TEAM #1

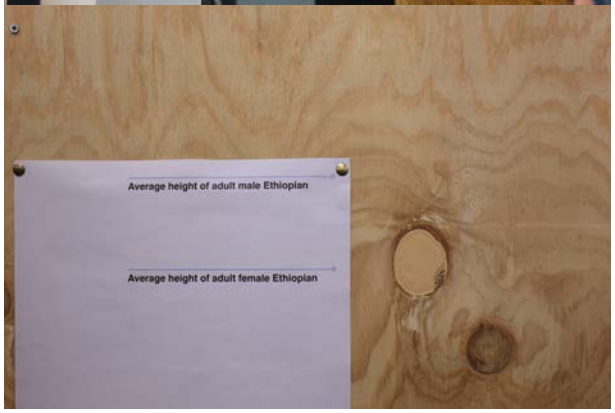
1st place

Team members:
Harry, Sascha, Saron, Doug

SUMMARY OF UNIT

- One integrated, freestanding pole using 250mm diameter plumbing drainage pipe and fittings .
- Water stored at relatively low height above the wash area, hinged lid made filling easy
- Tap to activate water flow
- 2 x irrigation nozzle jets for face and hand washing
- Hand basin with small drain hole to encourage water to pool for washing
- Basin drains directly into lower water store
- Tap on lower wastewater store to drain used water for toilet floor cleaning

TEAM #1


Average height of adult male Ethiopian
Average height of adult female Ethiopian

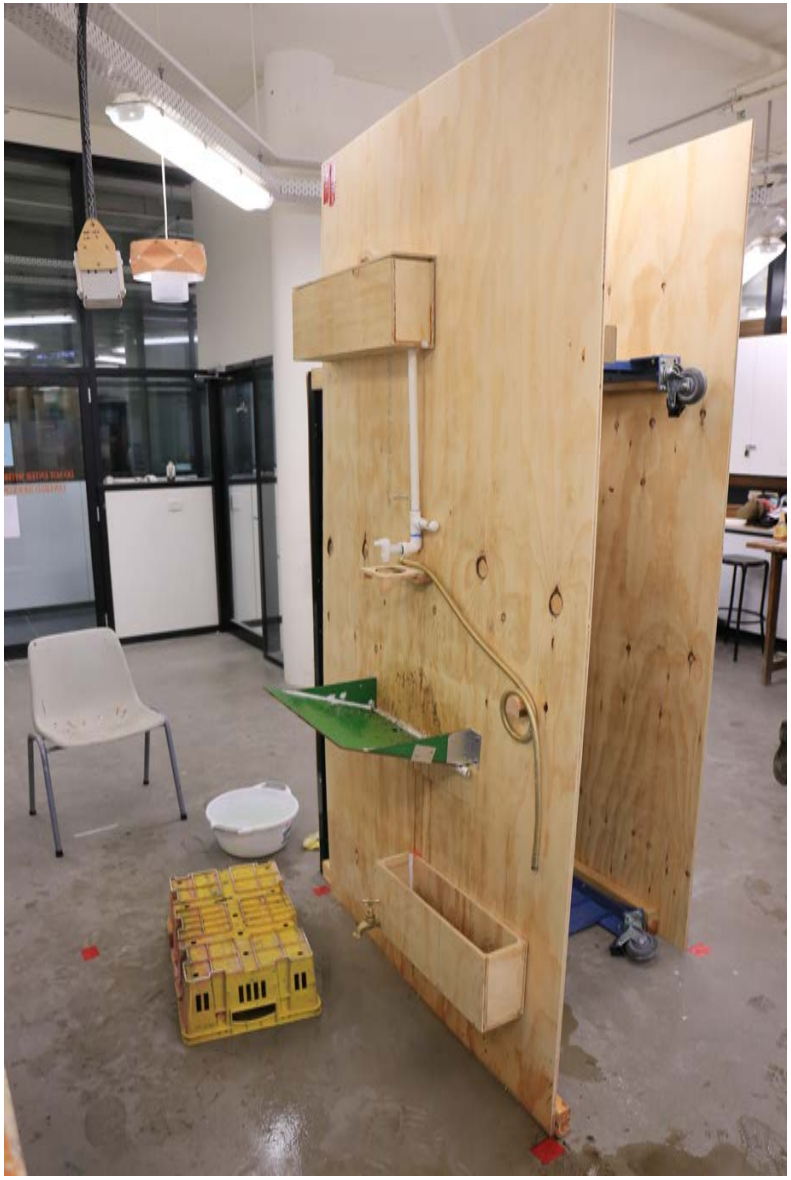
TEAM #2

3rd place

Team members:
Brian, Ming, Cassie, Sahibajot, Christopher

SUMMARY OF UNIT

- Top ply reservoir for water store, large lid easy to fill but still was high and required a chair, unlikely this material would be the final design material
- Pipe to tap that charged a small vessel to limit water use
- Constant flow from small tube made washing efficient
- Spray device for face did not work as pressure caused the spray mechanism to fail
- Basin collected wash water efficiently
- Pipe bonded to basin collected water and stored in plywood cistern below
- Tap of lower cistern allowed reuse of waste water for floor cleaning

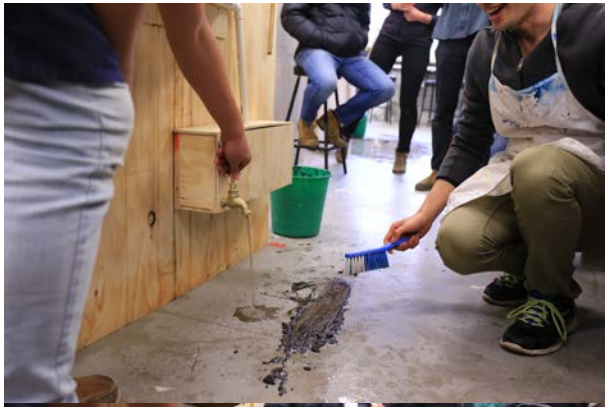


TEAM #2









TEAM #3

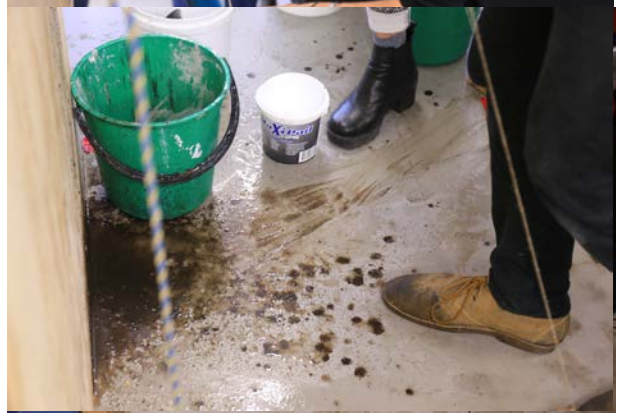
4th place

Team members:
Allisa, Ben, Sam, Zeynep

SUMMARY OF UNIT

- Plastic water carrying vessel as top cistern, hard to fill without removal from the wall, small inlet.
- Pipe from cistern to 2 x small plastic bottles that tipped when activated by foot controlled string links.
- The mechanism made the tipping action difficult and flow for the reservoir seemed restricted during the test
- No basin was provided or any means to capture the used water
- The use of found local materials for the main water vessels and foot activation of the water flow were considered important principles to be incorporated into any future designs.

TEAM #3



TEAM #4

2nd place

Team members:
Hugo, Rose, Callum, Vu, Cristina

SUMMARY OF UNIT

- Stand alone structure
- Plastic water carrying vessel as top cistern, with large top opening made filling simple
- Foot activated stop valve controlling water dumps from the top cistern into a smaller distribution cylinder worked with simple technology but may leak over time
- Water flow from the cylinder was directed at hands and face through 2 tubes. The lengths of the tubes delayed the face washing water arriving at the basin.
- Basin collected the water and discharged into a lower cistern that stored used water for floor washing.

TEAM #4

TEAM #5

5th place

Team members:
Truong, Danielle, Christine

SUMMARY OF UNIT

- Plastic bucket for water acting as top cistern, with large top opening but high required chair for filling
- Water flowed to 2 x spray units (that resembled eyes) to drench eyes using a ‘nose’ lever to activate the sprays. This did not function during the testing. Judges commented that if the unit was lower in height this may encourage child interaction with the face washing ‘nose and eyes’.
- Under the spray units was the had washing point, charged by a tap. The hand wash was meant to be fed via a syphon system limiting water used.
- The mechanism was 3D printed, robust and considered and deserves close examination for use in other designs.
- During the test, water was constantly being added into the top reservoir and it was hard to assess the function of the parts. There were many leaks in the system.

TEAM #5

Thanks

- All the teams for their ability to work and learn with those from other disciplines, for their thinking work and effort producing proto-type solutions
- The University staff and tutors who volunteered their time and the facilities of the University of Sydney, Faculty of Architecture
- To the judges for their time and expertise
- Jasper Ludewig for coordinating the event.
- Enware for providing examples of industrial washing solutions
- Heleana Genaus for photographs of the event.

Healthabitat – environmental health and design

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